

# CARDIOVASCULAR SYPHILIS\*

BY

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## Introduction

In the last ten to fifteen years, very little has been added to our knowledge of cardiovascular syphilis in spite of a number of published papers some of which have presented contradictory evidence concerning several unsolved problems. It is felt, however, that an attempt to review the subject may fulfil a useful purpose.

## Aetiology and Pathogenesis

Various problems in the aetiology and pathogenesis of cardiovascular syphilis are of current interest. No published figures concerning incidence and prevalence are fully acceptable because there has been no general agreement on diagnostic criteria either clinically or at autopsy. The Cooperative Clinical Group in the United States (Cole and others, 1937) published their findings in a group of 6,253 patients: 619 of these (9.9 per cent.) had cardiovascular syphilis. This group consisted of patients, both treated and untreated, with latent and late syphilis. In the Yale study, Rosahn (1946) found that of 118 autopsy examinations in which evidence of syphilis had been found, 83.1 per cent. had lesions of the cardiovascular system. On the other hand, in 224 (59 per cent.) of the 380 autopsies done in this series in patients known to have syphilis clinically, there was no microscopic evidence of syphilis. Rosahn also demonstrated that the infiltration of lymphocytes and plasma cells along the vessels between the muscle fibres of the myocardium was as frequent in non-syphilitic as in syphilitic patients, and should not be considered as autopsy evidence of syphilis but as a degenerative process, thus refuting the previously accepted concepts of Warthin (1918).

Race and sex are apparently potent factors in determining the incidence of cardiovascular syphilis

but no critical study has been done to compare this incidence. In the Cooperative Clinical Group, of patients with cardiovascular syphilis, 8.1 per cent. were white males; 31 per cent. were coloured males; 6.1 per cent. were white females; 12.8 per cent. were coloured females. These figures are in general agreement with those of other observers.

The effect in preventing cardiovascular syphilis of various types and amounts of treatment given either in early latent or in late syphilis is of interest. The only evidence at present is that adequate treatment (in terms of arsenical and bismuth therapy) given for early syphilis, almost completely eliminates the occurrence of cardiovascular syphilis. Kemp and Cochems (1937) published details of 208 patients with a ten-year follow-up. In those given no treatment or minimal treatment with trivalent arsenicals and bismuth, 27.6 per cent. developed cardiovascular syphilis; in those given inadequate treatment the figure was 13.9 per cent.; and in those who had received adequate treatment no such case occurred. But the analytical methods used in this study were thought by some to be unsound.

The possibility that the incidence of cardiovascular syphilis has changed with the passage of years has been considered by a number of investigators, but there is no agreement on this point. Welty (1939) analysed the incidence of cardiovascular syphilis in 15,000 autopsies at the Philadelphia General Hospital for the period 1927-1937. In the 1927-30 group the incidence was one in every eleven autopsies, while in the 1935-37 group it was only one in every eighteen autopsies. On the other hand Gelperin (1940) found that the autopsy incidence of cardiovascular syphilis at the Cincinnati General Hospital remained unchanged for the period 1926-37. But it is felt that in no city hospital is it permissible to assume that the autopsy material of any two years is comparable.

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The age of onset of clinically apparent cardiovascular syphilis would appear to depend primarily on the age at the time of the primary infection. Maynard (1942), in a study of 346 patients, 81 per cent. of whom were white, found that in 28 per cent. cardiovascular syphilis had developed within ten years of the initial infection and that this figure had risen to 56 per cent. within 20 years, and to 77 per cent. within 30 years of infection. The age of onset in the Negro is generally considered to be somewhat earlier than in the white patient. The role played by occupation before the onset of cardiovascular syphilis may be of considerable importance. Cochems and Kemp (1937), in a study of 749 patients with syphilis, found that the incidence of cardiovascular involvement was 14.1 per cent. in those doing heavy or moderate labour, while it was only 8.7 per cent. in those doing sedentary work. The incidence of aortic insufficiency and aneurysm was higher in the former group, while the incidence of uncomplicated aortitis was higher in the latter.

The degree of immunity still present in patients with cardiovascular syphilis is of interest in relation to the possibility of re-infection or super-infection. Thomas, Wexler, and Schur (1945) reported on a patient who had been treated for cardiovascular syphilis with aortic insufficiency and who had become sero-negative. Ten years after treatment he developed a dark-ground positive primary chancre. If the clinical picture merely represented the residual mechanical valve defect without any inflammatory activity, this would presumably be considered a re-infection; otherwise it must be considered as a super-infection.

The incidence of other forms of late syphilis in conjunction with cardiovascular syphilis is of clinical interest. It is generally agreed that the incidence of neurosyphilis, particularly *tabes dorsalis*, is fairly high. From a large amount of published data a figure of 25 per cent. would be a fair estimate of incidence. It has been stated that the occurrence of benign late syphilis is a rarity when cardiovascular involvement is present, but this is not the experience in some clinics where this incidence may be over 5 per cent.

Nabarro (1949) has recently discussed the question whether cardiovascular syphilis occurs in patients with congenital syphilis. Hinrichsen (1943), in an extensive review of the literature on this point, described a nodular and interstitial type of lesion in the myocardium in which spirochaetes had been demonstrated, but did not consider that valvular lesions occurred. It must be remembered too that cardiovascular syphilis may occur at an early age because of an acquired infection of syphilis in infancy, and that this type of patient may be

diagnosed as a congenital. Schamberg (1946) gives the case histories of five such patients; their ages ranged from 14 to 31 years at the onset of the manifestations of cardiovascular syphilis, and in two of them the duration of infection (from the lesions of early syphilis) was known with certainty. An excellent bibliography of other similar cases was also presented in this paper.

The infectivity of aortic tissue in cases of syphilitic aortitis has recently been confirmed by Hu, Liu, Chen, and Frazier (1946). At an autopsy performed 32 hours after death on a Chinese rickshaw driver with syphilitic aortic insufficiency, tissue was taken from the aorta and inoculated into a rabbit's testis. A syphiloma developed, but no change occurred in a rabbit similarly inoculated with the patient's blood. The patient was untreated and died 25 years after his original infection.

### General

In the recent past great efforts have been made by clinicians to close the gap between ante-mortem and post-mortem diagnosis in cardiovascular syphilis. The most important principle which is now widely accepted is that every patient with late or latent syphilis should have a detailed clinical examination of the cardiovascular system and a routine radiological examination by fluoroscopy with teloradiograms in the postero-anterior and oblique positions. In selected cases, an electrocardiogram, a phonocardiogram, or an angiocardiogram may aid in diagnosis.

Cardiovascular syphilis may be classified in three main categories:

- (1) Syphilis of the heart.
- (2) Syphilis of the medium-sized arteries.
- (3) Syphilis of the great vessels.

**(1) Syphilis of the Heart.**—This condition may be divided into diffuse myocarditis and gumma of the myocardium; both diagnoses are normally made at autopsy. It has already been mentioned that there is difference of opinion concerning the microscopic pathology of syphilis of the heart. Saphir (1942) was of the opinion that syphilitic myocarditis was rare, and that the *Treponema pallidum* should be demonstrated either in stained sections at autopsy or by rabbit inoculation. On the other hand Norris (1937) did not consider that these criteria need be fulfilled. He believed that the condition should be suspected in any patient with early or latent syphilis who developed cardiac symptoms. Magill (1935) believed a clinical diagnosis of myocarditis to be justified by positive blood tests for syphilis in a patient under 45 years of age

who had developed moderate cardiac decompensation with cardiac hypertrophy unexplained by any other aetiology. There should be neither cardiac murmurs nor elevation of blood pressure. It should be emphasized that the clinician must be certain that a soft aortic diastolic murmur is not present before making such a diagnosis.

Gumma of the myocardium is also rare. O'Daly (1943) stated that this type of gumma might become encapsulated, or calcified, or necrotic, in the last case with development of an aneurysm of the heart; and that syphilitic aortitis might or might not be present. Sohval (1935) stated that the most frequent site of a gummatous change was in the left ventricle at the base of the interventricular septum, and that the diagnosis should be suspected in the presence of "unusually situated weird stenotic murmurs, unexplained x-ray shadows at the cardiac margins, and heart block in a patient with syphilis." Various other writers (Reifenstein, 1936; Von Haam and Ogden, 1938; Spain and Johannsen, 1942; Cossio, Vivoli, and Caul, 1937; Coelho and d'Oliveira, 1939) have described autopsy findings of single or multiple gummata involving the myocardium, the mitral, tricuspid, or pulmonary valves, the origin of the pulmonary artery, and the pericardium. Electrocardiographic ante-mortem changes showed various types of heart block and ventricular tachycardia.

**(2) Syphilis of the Medium-Sized Arteries.**—The cerebral, spinal, carotid, hepatic, mesenteric, renal, iliac, and femoral arteries may all be occasionally involved. Cerebral and spinal vascular syphilis is usually classified with neuro-syphilis on account of the fact that the main signs and symptoms are referable to the nervous system. It is well known that intracranial aneurysm is rarely due to syphilis (McDonald and Korb, 1939). Potenza (1943) described changes at autopsy due to syphilis in the carotid, mesenteric, and femoral vessels in thirty out of 43 patients examined histologically at autopsy. He demonstrated the typical round-cell infiltration and destruction of the elastic layers of the media. Malloy and Jason (1942), in a review of the literature concerning aneurysm of the hepatic artery, found that only seven were stated to be due to syphilis. The normal symptoms or signs were abdominal pain, haemorrhage into the gastrointestinal tract or abdominal cavity, and jaundice. Schamberg (1946) described saccular aneurysm of an iliac vessel, and Price and Skelton (1948) recently reported occlusion of the renal artery. Both these autopsy findings were due to syphilis. From the clinical standpoint syphilis of the medium vessels (excluding the cerebral and spinal vessels) is of

importance only if aneurysm or occlusion occurs, and these are rare manifestations.

**(3) Syphilis of the Great Vessels.**—Lesions may occur in the aorta, in the pulmonary artery, in the innominate artery, in the subclavian, or in the common carotid arteries. Syphilis of the aorta is by far the most common and can be more clearly described if it is subdivided into a number of categories:

- (i) Uncomplicated aortitis.
- (ii) Coronary ostial stenosis.
- (iii) Aortic insufficiency.
- (iv) Aneurysm.

**UNCOMPLICATED AORTITIS.**—It has been argued on the basis of autopsy findings that the dilatation of the aorta which occurs as a result of the destruction of the elastic tissue in the media by the syphilitic process should be diagnosed more often during life. It is also assumed that, as the invasion of the aorta by spirochaetes probably takes place in the stage of early syphilis, aortic dilatation might begin to be apparent quite early in the period of latency. Thus, theoretically, it should be possible to make a diagnosis many years before aortic regurgitation or aneurysm develops, or before the process narrows or occludes the openings of the coronary arteries. Mattman and Moore (1943) considered that non-radiating substernal pain which was usually intermittent and not associated with exertion was a symptom of uncomplicated aortitis. They also asserted that paroxysmal nocturnal dyspnoea and other symptoms of diminishing cardiac reserve might occur, and that cardiac failure might supervene. On the other hand, Dressler (1945) considered that uncomplicated aortitis was asymptomatic. Wilson (1937), in an analysis of the case histories of 194 patients with autopsy findings of cardiovascular syphilis, found that 59 out of 106 patients with uncomplicated aortitis had no symptoms, and that all but one of 47 patients with symptoms suffered from some other cardiac conditions which might explain them. Moore (1949) feels that, in the absence of hypertension and arteriosclerosis, the characteristic accentuation and tympanitic quality of the aortic second sound is the only significant physical sign in clinical diagnosis. Previously Mattman and Moore (1943) and Maynard (1942) had considered that the presence of a systolic murmur at the aortic area was also an aid in diagnosis. Most controversy has arisen in relation to radiologic diagnosis. Kemp and Cochems (1937) took tele-radiograms and made measurements of the aorta by the technique of Vaquez and Bordet (1920) in 600 patients with no evidence of syphilis, and in

1,000 patients with syphilis. The incidence of cardiovascular syphilis in the latter group was 12.7 per cent. They came to the following conclusions :

1. Increased widening of the supracardiac shadow resulting from arteriosclerosis with or without hypertension was the same in non-syphilitic patients as in syphilitic patients without cardiovascular syphilis.

2. Increased width of the aortic shadow in advancing age was the same in non-syphilitic patients as in syphilitic patients without cardiovascular syphilis.

3. Only 59 per cent. of patients with clinical syphilitic aortitis showed x-ray evidence of aortic dilation. Boharas, Hollander, and Goldsmith (1942) examined 200 syphilitic patients who had neither aneurysm, hypertension, nor other vascular disease, and compared this group with 200 non-syphilitic patients. They measured the aorta by various recognized techniques and in general found no significant differences, although they thought that the root of the aorta was probably broadened by the Hampton method (1930) in the syphilitic group (6.2 to 7.4 cm. in 14 per cent. of syphilitic and in 7.5 per cent. of non-syphilitic patients).

Moore (1949) sums up the present position by stating that radiologic examination "should be by fluoroscopy, the use of the oblique position or by roentgen kymography. It cannot rest on Vaquez-Bordet measurements of aortic width, nor on other measures of aortic mensuration, unless distortion be extreme." The technique of angiocardiology, using 70 per cent. diodrast, first described by Robb and Steinberg (1938), may add a further important diagnostic method. Dotter and Steinberg (1949) state that "the angiocardigraphic signs of syphilitic aortitis represent a definite contribution toward the early detection of cardiovascular syphilis. The angiocardigraphic signs of syphilitic aortitis are abnormal dilatation of the ascending aorta (above 38 mm. calibre) as measured in the left anterior oblique projection; irregularity of the aortic lumen; variations in aortic wall thickness and aortic aneurysm." It is taken that this last reference is to fusiform dilation of the aorta, sometimes termed "fusiform aneurysm". They add a few words of caution however: "Dilatation, the most significant evidence of the early changes in syphilitic aortitis must be evaluated with care since it may also be caused by hypertension, non-syphilitic aortic insufficiency, and by congenital anomalies of the aortic arch." It should be added that one of the great values of angiocardiology is that the first part of the ascending aorta which is normally obscured by the heart shadow is visualized, and, of course, it is this part of the aorta which is most commonly involved in syphilitic aortitis. Cole and Bohning (1944) in reviewing their cases did not

believe that there were any specific electrocardiographic changes in syphilitic aortitis (provided there was no coronary ostial involvement).

There are a number of physicians who believe that uncomplicated syphilitic aortitis cannot be diagnosed ante-mortem. Kampmeier, Glass, and Fleming (1942) analyzed the case histories of 33 patients, who were discovered at autopsy to have uncomplicated syphilis of the aorta, and found no symptoms or signs whereby a diagnosis could have been made, taking into consideration the presence of other cardiovascular conditions, again provided that there was not coronary ostial stenosis.

**CORONARY OSTIAL STENOSIS.**—When the first part of the ascending aorta is involved in the syphilitic process, the ostia of the right and left coronary arteries may be narrowed or completely occluded, producing either myocardial ischaemia with a developing non-specific fibrosis, or, very occasionally, an infarct of the myocardium. Von Glahn (1937) considered that this process occurred particularly when there was an anomaly of the coronary ostia placing them distal to the aortic ring rather than in the sinuses of Valsalva to which point the syphilitic process rarely spreads. He stated that this occurred in eighteen of nineteen patients whom he had studied at autopsy.

Coronary ostial involvement may occur in patients who have otherwise uncomplicated aortitis, but its highest incidence is with involvement of the aortic valve ring producing aortic regurgitation; it may also occur, but less commonly, in patients with aneurysm. This ostial involvement is the most common cause of cardiac pain occurring in cardiovascular syphilis. Bruenn, Turner, and Levy (1936) reported autopsy studies on 64 patients with syphilitic aortitis. A history of cardiac pain was not noted in any who had not developed coronary ostial involvement. In a detailed clinical study of 103 patients with syphilitic angina pectoris (eighty men and 23 women), Jones and Bedford (1943) found that aortic regurgitation was present in 67, dilatation of the aorta in 59, cardiac hypertrophy in 83, and essential hypertension in 26. Out of 94 recorded electrocardiograms, 57 were abnormal. Angina of effort occurred in 76 patients, while in 64 there was pain present without exertion, and in these patients nocturnal attacks without associated paroxysmal dyspnoea were common. Such attacks were prolonged but were relieved by nitrites. Twelve of these patients ultimately came to autopsy. There was no evidence that uncomplicated aortitis caused anginal pains. Bourne (1935) discussed three types of anginal pain occurring in patients with cardiovascular syphilis; typical angina of

effort, additional spasmodic angina at rest in some patients with aortic regurgitation, and nocturnal pain of the substernal type which was often referred to the back. He noted that if there was no aortic regurgitation the left ventricle was not enlarged. Pincoffs and Love (1934) made a clinical and autopsy study of fifteen patients with coronary ostial stenosis. They state that after the onset of symptoms the course of the disease was brief with a high incidence of angina of effort, and that sudden death was a common occurrence. They found no pathological evidence of syphilitic myocarditis. Usually the syphilitic process only involves the coronary ostia, but Strassmann and Goldstein (1942) have described one patient, a white female 35 years old, who came to autopsy. The whole length of the coronary arteries was involved with a process of round cell infiltration; there was no evidence of arteriosclerosis. Myocardial infarction is rare in cardiovascular syphilis, but may occur on account of either thrombosis or embolus. Porter and Vaughan (1940) found 27 cases of coronary embolism with syphilitic aortitis reported in the literature, and added three cases in a review of 3,000 autopsies. Burch and Winsor (1942) described three patients with coronary ostial stenosis and myocardial infarction in a review of 6,225 autopsies. In the reported cases the patient died in a few hours; the pathology in the myocardium was similar to that in arteriosclerotic coronary disease. Cole and Bohning (1944) described electrocardiographic finding of a typical anterior myocardial infarct in three similar cases. Ostial involvement may vary from narrowing to complete occlusion, and one or both of the coronary ostia may be affected. Berk (1941) in an autopsy examination of 35 patients found that there was ostial narrowing in 26 patients and in twelve of these both ostia were affected. He stated that in some cases graduated exercise produced electrocardiographic evidence of coronary insufficiency, although the electrocardiogram taken at rest was normal. Sprague (1942) stated that bundle branch block might indicate considerable coronary obstruction. Blackford and Smith (1938) however, in a study of 128 patients with aortic insufficiency, found that the incidence of electrocardiographic changes was very similar in patients with and without heart pain.

**AORTIC REGURGITATION.**—The insufficiency of the aortic valves is more commonly caused by dilatation of the aortic ring than by primary valve involvement. The cusps may be involved later in the syphilitic process with fibrosis causing distortion and the typical rolled-up edge. Wilens (1940) examined at autopsy the heart and aorta of 45 patients

with cardiovascular syphilis, 24 of whom had developed aortic regurgitation, and of 73 patients without syphilis. He found that the extension of the elastic layers of the media may project proximally past the attachment of the cusps, so that in syphilitic aortitis the degree of regurgitation may depend on the presence or absence of this projection of the media.

**Symptoms.**—It is extremely important to realize that syphilitic aortic regurgitation may be symptomless. McDermott, Tompsett, and Webster (1942), in an analysis of 91 patients with syphilitic aortic regurgitation but without aneurysm, found that 49 per cent. had no cardiac symptoms at the time of diagnosis. The commonest symptoms are dyspnoea on exertion and paroxysmal nocturnal dyspnoea, apart from angina of effort and other substernal pain which probably depend on coronary ostial stenosis. Occasionally the patient may present complaining of pounding in the head or roaring in the ears as the only symptom of aortic regurgitation.

**Signs.**—The classical signs of aortic regurgitation have been summarized by White (1944) as follows :

A blowing, aortic diastolic murmur, rarely musical in quality, high pitched or low pitched, often very gentle, better heard with a diaphragm stethoscope. Onset immediately after or with the aortic second sound (which may be obliterated). Maximal intensity to the left of the sternum in third and fourth spaces with wide transmission to the apex, the left axilla and towards the neck. Better reception with the patient in the sitting position. A diastolic thrill is rare the diastolic murmur is decrescendo and lasts through most of diastole. First heart sound is not accentuated and a third heart sound is not heard. There is often an aortic systolic murmur. A number of further points which are particularly useful in the diagnosis of syphilitic aortic regurgitation should be added. The presence or absence of the aortic second sound is of some importance. If the second sound is present there is probably only dilatation of the aortic ring, and there may be no peripheral signs, but if the second sound is absent it is probable that the valves have also been involved and there are usually marked peripheral signs. If there is a very loud "to" and "fro" murmur at the aortic area it may be difficult to decide whether the second heart sound is preserved, but this point may be decided by auscultation over the neck vessels, where the murmurs are less loud and the transmitted second sound is heard if present. The intensity of the diastolic murmur is sometimes maximal over the xiphisternum, or to the right of the sternum, and occasionally at the apex. It is sometimes extremely difficult to hear an aortic diastolic murmur and the method of auscultation with the patient leaning well forward and holding his breath in full expiration is often employed. Some physicians also listen by directly applying the ear to the chest wall. The difficulty of

auscultation in a ward or in an out-patient department when a very soft diastolic murmur is present must be emphasized; the ideal situation would be a small sound-proofed room.

The peripheral signs of aortic regurgitation due to the increased pulse pressure may be misleading. They may be present in other conditions such as essential hypertension and Graves' disease, and as already mentioned may be absent in aortic regurgitation which is due to a dilated aortic ring. Levine (1949) states that a vascular sound similar to the classical "pistol shot" sound heard over the femorals may be heard below the clavicle. The sign of increased systolic blood pressure in the legs has often been quoted. It is interesting to note that Kotte, Iglaue, and McGuire (1944) pointed out that even if a 15.5-cm. cuff was used the readings did not compare with direct measurements. They inserted a small needle into the femoral artery of ten patients with aortic regurgitation, measured systolic and diastolic pressure by means of a specially designed optical manometer, and compared the readings with blood pressure readings taken with a 15.5-cm. cuff. The cuff reading recorded a 29 per cent. higher systolic pressure. Even so they found femoral systolic blood pressure was more frequently elevated above brachial systolic pressure in patients with aortic regurgitation than in normal or hypertensive patients.

The Austin Flint murmur, a presystolic rumble localized and best heard at or in the region of the apex beat, is not uncommonly heard in patients with aortic regurgitation. Various theories regarding its cause have been put forward. Gouley (1941) performed an autopsy examination on ten patients who had demonstrated this sign during life. In all cases, he found a concave cup-shaped deformity of the inner portion of the right aortic cusp. This portion sagged and its free margin pouched outwards into the ventricle. The other leaflets were normal or only slightly involved. There was also thickening of the anterior mitral cusp on its ventricular aspect, and sometimes an opacity at the attachment of the chordae tendineae, and sclerosis of the adjacent mural endocardium. This might be taken to confirm the theory that the regurgitating blood strikes the anterior mitral cusp and pushes it laterally into the auriculo-ventricular blood stream, setting up vibrations and producing a functional obstruction of the mitral valve.

Occasionally a patient presents with a loud musical or "dovecote" diastolic murmur which may be audible to the examiner without applying a stethoscope. This is usually considered to be due to rupture or perforation of an aortic valve cusp, but it may also be due to retroversion of the cusp. Bellet, Goulet, Nichols, and McMillan (1939)

described eleven patients who had a typical "dovecote" murmur: six came to autopsy and in every one only retroversion of the right anterior aortic valve cusp was present.

X-ray findings are not usually of much additional help in the diagnosis of aortic regurgitation. Nichols (1940) found in his series of seventy patients that 93 per cent. had an enlarged left ventricle, and this ventricular hypertrophy may of course be confirmed radiologically. In some cases, however, hypertrophy is not marked, especially in those with few peripheral signs. An electrocardiogram usually shows left axis deviation. In fact, Sprague (1942) pointed out that the absence of this deviation in a patient with regurgitation was usually due to some complicating condition. Changes in the T waves and in the ST segment, sometimes termed left ventricular strain, were considered by Parsonnet and Bernstein (1943) to be due to left ventricular hypertrophy rather than to coronary insufficiency. Blackford and Smith (1938) stated that there was some correlation between the clinical course and electrocardiographic changes, such as widening or notching of the QRS complex in 47 patients with aortic insufficiency.

*Differential Diagnosis.*—It is usually considered that it is comparatively simple to make a diagnosis of aortic regurgitation. It has already been mentioned that a very soft diastolic murmur is often extremely difficult to hear with certainty, and there may be differences of opinion among physicians examining such a case. However, once it has been agreed that a patient has an aortic diastolic murmur, the problem of the aetiology of the lesion has to be solved. Apart from syphilis, rheumatic carditis, bacterial endocarditis, arteriosclerosis, and calcific disease, have to be considered singly or in any combination. Of course, the case in which there is more than one aetiological factor is the most difficult problem, usually solved only at autopsy. Lisa, Solomon, and Eckstein (1942) reported on fourteen patients; in nine of these the aortic valve was involved in both a syphilitic and rheumatic process; rheumatic mitral valvulitis was present in all the cases. They stated that the prognosis and response to treatment was poor, the majority died in cardiac failure within 18 months. Bacterial endocarditis either acute or subacute may be superimposed on a syphilitic aortitis. Braunstein and Townsend (1940) described twenty such cases, seven of the acute and thirteen of the subacute type. The acute cases occurred chiefly in males; there was marked dyspnoea at the onset with typical signs of aortic regurgitation and septicaemia. At autopsy, in addition to syphilitic aortitis, there were large

vegetations on the valves ; pyogenic organisms were usually cultured. In the subacute variety, also chiefly in males, there was progressive dyspnoea followed in a few months by congestive failure ; fever and anaemia were common findings. Embolic phenomena were rare. At autopsy, in addition to syphilitic aortitis, there were small vegetations on the aortic valves with a marked tendency to healing. There was no evidence of rheumatic carditis ; streptococcus viridans was grown in culture in some cases, in others there was no growth. It is common to find varying degrees of arteriosclerosis with or without calcific disease in combination with syphilitic aortitis in the higher age groups. Epstein (1938) has stated, however, that arteriosclerotic changes alone rarely produce incompetence of the aortic valves. It has also been stated that this type of regurgitation is minimal and that peripheral signs are rare. There is difference of opinion in relation to calcific disease ; Blumenthal, Lansing, and Wheeler (1944), after a study of sections from the aorta in 582 patients, stated that age and hypertension were more important factors than syphilis in the production of calcium deposits. More recently, however, Jackman and Lubert (1945) found at autopsy that 22.7 per cent. of 66 patients with syphilitic aortitis had linear calcification of the aorta, while only 3.2 per cent. of 62 patients, with an average age of 70, gave a similar finding. Thorner and Carter (1948) reviewed 111 cases of syphilitic aortitis in which x-ray films were available ; linear calcification of the thoracic aorta was present in 37 cases (33.3 per cent.) and in sixteen of these cases it was in the ascending portion. They state that this finding is diagnostic of syphilitic aortitis, and is particularly valuable in the differential diagnosis of aortic regurgitation. It is doubtful whether such a dogmatic statement is justifiable, but it must be appreciated that calcium deposition quite often occurs in syphilitic aortitis.

When the problem of diagnosis is between the above-mentioned diseases it should be possible to make a correct diagnosis in most cases. In rheumatic carditis, which generally presents in a younger age group, there may be or may not be a definite or suggestive history of rheumatic fever. A history of cardiac murmurs present since youth may be obtained. If the aortic valve is involved, aortic stenosis is more common and there is often also a mitral valve lesion producing a diastolic murmur which must not be confused with an Austin Flint murmur. Auricular fibrillation is common while it is a rarity in cardiovascular syphilis. By x-ray examination and fluoroscopy there is no evidence of aortic dilatation, and there may be evidence of left auricular dilatation if there is a mitral lesion. Blood tests

for syphilis are negative. If subacute bacterial endocarditis supervenes in a patient with an aortic diastolic murmur, it is further evidence of a rheumatic infection bearing in mind that on rare occasions bacterial endocarditis can complicate a syphilitic aortitis as already mentioned. There does not seem to be any certainty of differentiating aortic regurgitation due to arteriosclerosis, especially if the blood tests for syphilis are positive. Aortic calcific disease with involvement of the aortic valves and aortic stenosis has usually been taken to exclude the diagnosis of syphilitic heart disease. But Woodruff (1948), in a study of 41 patients with cardiovascular syphilis, found that in 7.3 per cent. of his patients who came to autopsy there was calcification of the aortic valves with stenosis in addition to aortic insufficiency with widening of the valve commissures.

The possibility of patients with untreated cardiovascular syphilis having negative blood tests further complicates the diagnostic problem. Beckh (1943) studied the case histories of 100 patients who came to autopsy between 1933 and 1942. The technique of blood testing by the Wassermann and Kahn methods had remained unchanged during those years. In 4 per cent. of these patients, the blood tests were negative. The development of the treponemal immobilization test by Nelson (1949) will probably help to resolve this difficult clinical problem. He has already found a positive immobilization test in four patients with aortic insufficiency with negative routine blood tests. Autopsy evidence of aortic syphilis, however, will be needed to finally confirm these results.

**ANEURYSM.**—In this paper aneurysm is taken to mean diffuse or saccular aneurysm ; areas of limited localized dilatation of the aorta, sometimes termed fusiform aneurysms, are considered to come under the heading of aortitis. A saccular aneurysm arises from the aorta by a small orifice, and there may be further pouches arising from the sac, termed daughter aneurysms. In some cases aneurysms may arise from a broader base. Ulceration of the endothelial lining of the sac may occur causing rupture, or may heal by the laying down of fibrous tissue. Thrombosis and calcification sometimes occurs in a sac or a daughter sac ; this may markedly change its pulsatile qualities. Aneurysm of the aorta due to syphilis is stated to be far commoner above than below the diaphragm. Kampmeier (1938) in an analysis of 467 patients with aneurysm of the thoracic aorta found that the blood tests were positive in 289 (62 per cent.), but when patients who gave a past history of syphilis or of some treatment for syphilis were included the incidence rose to 84 per cent. In this study of cardiovascular syphilis

Kampmeier had accepted 633 case histories of patients as suitable out of 1,113 examined. He assessed that the ante-mortem diagnosis was made only once in one thousand medical admissions, whereas the post-mortem diagnosis was made once in every hundred admissions.

It is well to emphasize the point that even large aneurysms may present neither symptoms nor clinical signs suggesting the correct diagnosis. In these cases, the diagnosis depends entirely on radiologic examination.

The ascending aorta is the commonest site of aneurysm; it usually bulges laterally into the right lung field and anteriorly in contact with the ribs and sternum, so that pulsation in the second or third interspace may be the only presenting sign. As the aneurysm increases in size it may erode the ribs and sternum producing symptoms of bone pain, and may finally appear as a pulsating mass under the skin of the anterior chest wall. Sometimes, however, it extends medially and may displace the trachea to the left or press on or rupture into the pulmonary artery. Brill and Jones (1946) stated that in aneurysms which compress the pulmonary artery the strain was predominantly on the right ventricle, so that when right-sided cardiac failure supervened in a patient with an aortic aneurysm this condition should be suspected. Porter (1941) described three patients in whom an aneurysm had ruptured into the pulmonary artery. They developed continuous and severe dyspnoea with only slight pulmonary stasis and right heart failure; cyanosis was not significant. There was a purring systolic and diastolic thrill over the base of the heart and a long harsh murmur in the third left interspace, with a long systolic and short localized diastolic murmur best heard with the patient sitting. There was no Austin Flint murmur, but peripheral signs of a wide pulse pressure were present. There was right axis deviation in the electrocardiogram. The phonocardiogram was similar to that in patent ductus arteriosus. White, Chamberlain, and Kelson (1941) described a patient who only survived for 21 minutes. X-ray examination showed a bulging of the pulmonary artery in addition to other signs.

An aneurysm bulging postero-medially may compress a bronchus producing atelectasis with or without bronchiectasis, or may rupture into a bronchus producing a fatal haemoptysis. On rare occasions it may rupture into the pleura or pericardium. Goldstein (1949) discussed 29 cases of spontaneous rupture of an aneurysm into the pericardium. The usual outcome is death by cardiac tamponade.

Aneurysm of the arch of the aorta usually arises from its convex surface. It may appear as a

pulsating mass in the suprasternal notch and may press on the trachea, producing stridor. It may involve the recurrent laryngeal nerve causing hoarseness and a brassy cough, or it may press on the oesophagus causing dysphagia. Pressure on the cervical sympathetic chain will produce Horner's syndrome, while pressure on the superior vena cava may produce cyanosis, oedema, and dilatation of the superficial veins of the arms, upper chest, and neck. Hinshaw and Rutledge (1942) analyzed the case histories of 22 patients with signs of superior vena cava obstruction and found that in two cases an aortic aneurysm was present. Occasionally an aneurysm may actually rupture into the superior vena cava. Armstrong, Coggin, and Hendrickson (1939) analyzed 98 such cases and added two of their own. Syphilis was proved in 77 per cent. of 26 such cases occurring since 1925. The following signs and symptoms occurred in this order of frequency in eighty patients: cyanosis, swelling of upper thorax, dyspnoea on exertion, severe chest pain, unconsciousness, orthopnoea, and dysphagia. The onset of these signs and symptoms is often sudden. There were abnormal cardiac sounds in 77 (in thirty a machinery murmur and in twenty-two a "to and fro" murmur at the base of the heart). There were 154 deaths in less than one month after the onset of symptoms; in three death was instantaneous. In only three cases was a collateral circulation established.

If an aneurysm of the arch presses on the innominate or left common carotid or subclavian arteries, the signs of diminished or absent pulsation in the neck or arms may be present, producing variation in the blood pressure in the arms and also possibly asynchronism of the pulses varying according to which of the great vessels is involved. Maurer (1939) described five such cases from the literature and added two of his own confirmed at autopsy; the presenting complaint may be cerebral anoxaemia. It should be remembered that these findings may also be caused by obstruction or aneurysm of the vessels themselves, and will be mentioned under that heading. Finally an aneurysm projecting backwards may erode the bodies of the 4th, 5th, and 6th thoracic vertebrae while the intervertebral disks are spared.

Aneurysm of the descending thoracic aorta is often symptomless. It may project to the left and anteriorly or posteriorly. Lowenberg and Baer (1946) discussed the clinical and radiologic features of aortic aneurysm and mentioned displacement of the oesophagus to the left and anteriorly, similar to the displacement by a right-sided aortic arch. Erosion of the bodies of the lower thoracic vertebrae is given as another characteristic sign producing



deep and continuous boring bone pain. If this vertebral involvement is severe, compression of the spinal cord producing neurological signs may occur. Shimkin (1939) has reviewed 44 such cases in the literature and has added two cases of his own.

There is great difference of opinion how often an aneurysm of the abdominal aorta is due to syphilis. Mills and Horton (1938) found that in only 8.8 per cent. of eighty cases was this so. More recently, however, Scott (1944), in a review of 62 patients with abdominal aneurysm at the Johns Hopkins Hospital, found evidence of syphilis in 74, while arteriosclerosis was the aetiological factor in only 21 per cent. In 14.4 per cent. of the syphilitic group aneurysms were multiple. Scott stated that aneurysm above the origin of the renal artery was usually due to syphilis, but that below this level syphilis was rarely the cause. The most significant symptom was pain in abdomen or back. It was most severe at night and was relieved by change of position. Aneurysms due to arteriosclerosis were usually asymptomatic. The presence or absence of characteristic physical manifestations—a mass exhibiting an expansile pulsation; a palpable thrill and an audible murmur were related to the site and size. In the syphilitic group 34 per cent. also had aneurysm of the thoracic aorta, and an additional 18 per cent. had syphilitic aortic regurgitation. Erosion of vertebral bodies from the 11th thoracic to the 2nd lumbar was present in some cases, while in others calcium was present in the wall of the aneurysm.

Radiologic examination by fluoroscopy and by taking teleradiograms in the postero-anterior and oblique positions with a barium swallow is a necessary aid to diagnosis in all cases of aneurysm of the aorta, and many of the above-mentioned findings can only be demonstrated by these methods. Schwedel (1946) has given a full and excellent description of their interpretation. In addition, angiocardiology may be of great assistance, and Dotter and Steinberg (1949) stated :

“The diagnosis and delineation of aortic aneurysm has been made a simple process by angiocardiology; previously inaccessible sites of aortic dilatation such as the sinuses of Valsalva may now be clearly outlined. The rare instances of clotted aneurysms which do not fill with contrast substance are usually recognized by the demonstration of collateral evidences of syphilitic aortic disease.”

This method is also of considerable use in the differential diagnosis of an aneurysm from other mediastinal or intra-abdominal masses. It must be realized, however, that the necessary technique and apparatus are complicated and that the contrast medium is much diluted by the time it reaches the

aorta. Untoward reactions have occurred, especially on repeating injections. It is probable that at the present time only one oblique or lateral view should be taken in each case, although methods are being developed by which a simultaneous postero-anterior and lateral view can be obtained with a single injection of diodrast.

Involvement of the pulmonary artery by a syphilitic process is rare, but pulmonary arteritis and aneurysm have been described. Boyd and McGavack (1939), who reviewed the literature concerning 109 cases of pulmonary aneurysm and added two of their own, thought that syphilis was the cause in only one third of the cases. Allan and McCracken (1940) described two patients with a similar diagnosis, in one of whom this was confirmed at autopsy. They considered that the typical onset was insidious with increasing dyspnoea, and that cough productive of blood-streaked sputum and even haemoptysis might occur. There might be considerable cyanosis. The onset of cardiac failure was also gradual. On examination one might expect fullness of the precordium with pulsation and a thrill in the region of the 3rd rib or interspace, and pulmonary systolic and diastolic murmur on auscultation. There might be right axis deviation in the electrocardiogram.

The great vessels arising from the aorta, the innominate, left common carotid, and left subclavian, may be involved by the syphilitic process. An innominate aneurysm may extend out behind the sterno-mastoid and press against the sternum or clavicle, and may be seen as a pulsating mass in this area. It may press downwards on the aorta and push the trachea to the left, or it may exert pressure on the brachial plexus. It may produce asynchronous pulses and a lowered systolic blood pressure in the right arm may occur. Radiological examination will reveal a dense shadow in the superior mediastinum with the aortic knob pushed downwards and to the left. Carotid and subclavian aneurysms are very rare. The proximal part of these great vessels is occasionally involved in a syphilitic process with marked proliferation of the intima which may partially or completely block one or more of these vessels, producing some or all of the signs already listed. Barker (1949) has recently reported a case of this type.

### Prognosis

The prognosis of cardiovascular syphilis is dependent on a knowledge of the natural history of the disease and the manner in which it may be affected by specific treatment. It is difficult to assess the prognosis of syphilitic myocarditis as cases are rare, but in general it is poor. In syphilis

of the medium vessels (apart from the cerebral and spinal vessels) the prognosis is good, provided neither aneurysm nor thrombosis occur. The prognosis of uncomplicated aortitis without coronary ostial involvement, appears to be very good. Moore (1947) quotes the outcome in 105 patients diagnosed at autopsy; only 24 died of causes in any way related to syphilis, and of these only ten died as a probable direct result of the aortitis; in the remaining 81 (77 per cent.) the final illness had no relation to syphilis of the aorta.

In aortic regurgitation and aneurysm where the problem of diagnosis is more clear cut the natural history of the disease can be considered in more detail. Before considering the various factors involved the error in diagnosis as demonstrated by autopsy must be considered. It is lower in aortic regurgitation than in aneurysm, probably less than 10 per cent. Race, sex, and age, as already mentioned, are all variants in prognosis. The problem of the patient's work status before the onset of cardiovascular syphilis has also been discussed. Work status, once cardiovascular syphilis has developed, is probably of even more importance; continuation of heavy labour may markedly shorten the duration of life. Patients attending clinics may be divided into two broad categories; those who first attend with symptoms referable to their cardiovascular condition, and those who attend for any other cause, for another disease, for a routine check-up, or as the result of routine blood-testing. It must be understood that the syphilitic disease process may be at a very different stage in each group. In other words, by the time cardiac symptoms appear, clinical evidence of the physical findings have probably been present for months or even years. Thus the time of survival from the date of diagnosis is not comparable in these two groups. The contrast is even more marked for those who have signs of congestive failure at their first attendance at a clinic. Even in this last group, prognosis is not uniformly poor. The old concept that these patients always died within two years is certainly not always true. With rest and good general medical care, it is not uncommon for a patient to recover from the first phase of cardiac failure. This is followed sooner or later by further phases of failure of which there may be as many as eight before death occurs. Multiple lung infarcts due either to thrombosis or to an embolus are often a terminal event. The presence or absence of coronary ostial involvement, as judged by angina of effort or other substernal pain and by electrocardiographic changes, is of the utmost prognostic importance. It may well be the main factor in shortening the duration of life, rather than aortic

regurgitation or an unruptured aneurysm. Of course, at any stage an aneurysm may first leak and then rupture in the various ways already described, but spontaneous thrombosis with later calcification may sometimes occur, greatly improving the prognosis. Any final assessment of the natural history of the disease in a group of patients must depend on an analysis of the cause of death. Was the cause of death directly due to cardiovascular syphilis, or was it directly due to some intercurrent disease or accident, or did some other disease combine to shorten life, or did the presence of some other manifestations of late syphilis, such as general paresis, have the same effect?

Finally it should be recognized that at any stage of cardiovascular syphilis a patient may die suddenly. Autopsy examination may reveal coronary ostial occlusion, rupture of an aneurysm, or damage to an aortic valve cusp. Death may occur suddenly in a patient with congestive failure; on the other hand he may be well compensated at the time of death. Leary (1940) discussed various causes, and Galbraith and Hardwick (1940) reported a death due to spontaneous rupture of the aorta into the pericardium. Often the autopsy findings give no clue as to the cause of sudden death.

### Treatment

Treatment for cardiovascular syphilis may be considered under three headings:

(1) **General Medical Care.**—Patients suffering from cardiovascular syphilis should be given instructions to modify their way of life. This modification will naturally depend on the severity of the condition. A patient with uncomplicated aortitis without evidence of coronary ostial involvement should be able to lead a normal life, provided that the heaviest type of work is avoided; whereas a patient with aortic insufficiency who has passed through a phase of congestive failure, or a patient with severe angina of effort, or with a large pulsatile aneurysm, should be advised to avoid all except a sedentary occupation. He should also be instructed to walk and to mount stairs slowly, to avoid excitement, and to avoid sexual intercourse. A phase of congestive failure is often precipitated by an upper respiratory-tract infection and patients should be protected as far as possible from this hazard. When congestive failure occurs the patient should be admitted to hospital and be given a low sodium diet, ammonium chloride by mouth, and a suitable mercurial diuretic, and should in addition be fully digitalized. On this type of regime the patient often recovers in a matter of weeks, and his after-care at home is in many ways a much more difficult problem. There is disagreement among physicians as to whether digitalis should be continued at a maintenance dose at this stage. This type of patient should be weighed at each out-patient attendance, and this often provides a helpful indication of the fluid balance. The use of the nitrites

for the relief of angina of effort is generally accepted, and patients may be supplied with liberal amounts of trinitrin tablets (gr. 1/100), but modification of his activity as above stated is a more important measure.

(2) **Surgical Treatment.**—Various techniques for the treatment of saccular aneurysm have been described. Penick (1938) described various operative methods for wiring aneurysms. Poppe and de Oliveira (1946) described an improved method by the application of polythene cellophane to fibrose and obliterate aneurysmal sacs. De Takats and Reynolds (1947) give an account of the progress of the treatment of eight patients with abdominal aneurysm. In four the aneurysmal sac was not treated; in one the sac was wired; in the remaining three the sac was banded with cellophane. Only the last three survived for any length of time.

(3) **Antisyphilitic Therapy.**—There is at present no complete agreement among clinicians as to the efficacy of antisyphilitic treatment in cardiovascular syphilis. There is difference of opinions as to whether autopsy findings bear out the assumption that therapy with trivalent arsenicals and bismuth was of help in the past. Hood and Mohr (1937) studied the microscopical changes in the aorta at autopsy in two groups of seventeen patients with cardiovascular syphilis. The first group had had at least eight months' continuous arsenical and bismuth therapy, while the second group had received no treatment. They found that the only difference in the two groups was in relation to the duration of the syphilitic infection. But, in a group of seventeen patients similarly examined, Howe (1943) found that cellular infiltration in the aortic wall was inversely proportional to the amount of arsenical therapy received. More recently, Webster and Reader (1948) examined sections from 45 patients, whom they divided into three groups: untreated, inadequately treated, and adequately treated. Approximately twenty arsenical and twenty bismuth injections were taken as minimum adequate treatment. Only three of the nineteen patients who had received adequate treatment showed any active type of syphilitic aortitis, while all nineteen untreated patients showed active cellular infiltration of the aorta. Unfortunately, papers concerning the treatment of cardiovascular syphilis published to date contain various biostatistical errors which invalidate many of their conclusions. The papers of Grant (1933), Padget and Moore (1934-5), and Stratton (1935) would suggest that adequate therapy with trivalent arsenicals and bismuth prolonged the expectation of life; the work of Kampmeier (1938), however, suggests that this is not so. Moore (1947) stated that optimum treatment for cardiovascular syphilis should consist of continuous alternating courses of trivalent arsenicals and bismuth for two years. One of the great difficulties in analyzing case histories is that very few patients completed this optimal treatment, and the problem is to decide what should be considered adequate treatment.

Since the introduction of penicillin, this drug has been used alone for the treatment of cardiovascular syphilis in some clinics in the United States. It is hardly surprising that no conclusions have been reached as to its efficacy

in this condition, since the similar problem concerning arsenic and bismuth therapy remains unsolved. Furthermore, it does not now seem feasible to collect a control group for the future: therefore the only possibility of solving both problems would be to collect an untreated control group from the past and compare it with arsenic and bismuth therapy on the one hand and with penicillin therapy on the other. There are very obvious biostatistical errors entailed in this method, but efforts have been made at the Johns Hopkins Hospital to collect such a series of cases. While it is possible that useful information as to the natural history of cardiovascular syphilis may be produced from this work, it appears doubtful whether the problem of the efficacy of the various forms of treatment will be solved on account of lack of comparability of the control group in relation to such factors as sex, race, and age.

It was recognized in the days of metal chemotherapy that there were two possible dangers in the administration of full doses of trivalent arsenicals in the treatment of cardiovascular syphilis. First, the Jarisch-Herxheimer reaction, sometimes termed therapeutic shock, and secondly the therapeutic paradox as a result of rapid healing and fibrosis. Some clinicians believed that bismuth might also produce a Herxheimer reaction. Both these reactions might, on occasion, prove fatal by the oedema or fibrosis of the coronary ostia, by the weakening and rupture of the wall of an aneurysm, or by distortion of the aortic valves producing increasing regurgitation of blood into the ventricle. On account of these theoretical dangers, most clinicians advised beginning treatment with small doses of bismuth which were gradually increased and continued once weekly for 10 to 12 weeks. This was followed by a small dose of trivalent arsenical, gradually increased at weekly intervals up to two-thirds of the usual dosage (0.3 g.). When penicillin was first used it was assumed that the same principles should apply. However, Moore, Farmer, and Hoekenga (1948) in a paper summarizing various fundamental investigations of the Jarisch-Herxheimer reaction, pointed out that this reaction (as indicated by pyrexia over 100° F.) occurred in less than half the cases of early syphilis studied, and did not appear to depend on the number of spirochaetes present in the body. They also made the important observation that the reaction did not occur if less than 5 units penicillin per kg. was given, but with doses from 10 to 120,000 units per kg. it occurred with essentially equal frequency. Tucker and Farmer (1947) treated 22 patients with syphilitic aortic regurgitation with penicillin only without any fatality. Five patients had fever over 100° F. in the first 16 hours; two had an exacerbation of the anginal pain which was previously present. They found no difference in febrile reactions between nine patients getting small initial doses (500 to 3,000 units) and 21 patients with larger initial doses (25,000 to 100,000). Up to May, 1949, Flaum and Thomas (1949) had treated fifty patients with syphilitic aortic regurgitation and ten patients with aneurysm, without any untoward reactions. In their paper, they reviewed and commented on the few cases reported in the literature of sudden death or other reactions following penicillin in cardiovascular syphilis.

Thus, at present, it appears that penicillin may be given in full dosage in the treatment of cardiovascular syphilis with minimal danger of the occurrence of severe reactions. Whether premedication with bismuth should be given, however, remains a matter of opinion. There is usually little urgency in treating this type of patient; on the other hand some might default during the phase of bismuth therapy. Finally it remains to be proved whether bismuth itself causes or prevents a Herxheimer reaction.

Falk, Edeiken, Ford, and Stokes (1949) treated twelve patients with cardiovascular syphilis who were in congestive failure with penicillin in addition to the usual general medical treatment for cardiac decompensation. The total penicillin dosage ranged from 4.8 to 9.6 mega units; three patients were given an initial dose of 500 to 1,000 units, seven were given 5,000 to 10,000 units, and two started with a 40,000 units dosage. There were two subsequent deaths, neither, they believed, due to penicillin; the others all recovered well. It was their impression that improvement was more rapid with penicillin given in addition to the general medical care. But, as has already been mentioned, it is the rule rather than the exception for a patient given the best general medical care to recover from a phase of congestive failure. It must be realized that at present there is no definite evidence regarding the efficacy of penicillin, once clinical cardiovascular syphilis has developed.

### Summary

A review of the present status of cardiovascular syphilis has been presented and reference has been made to most of the important work in this field published in the last 15 years.

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## DISCUSSION

Dr. Geoffrey Bourne said that after Dr. Nicol's extremely full and most interesting account of the subject he felt he had very little to add. The remarks he had to make were largely impressions because although cardiologists did see a certain number of patients with cardiovascular syphilis, they did not amount to a very long series in the course of a year. A few provocative remarks might encourage discussion.

The first decision to make with a patient who had angina of effort with syphilis of the aorta or syphilitic aortic incompetence was the stage of the manifestation in this particular patient. Since treatment was so individualistic and all patients varied in the stage of the disease in which they came for examination, statistics on a large unselected series of cases of aortic incompetence or of angina of effort of spirochaetal origin were difficult to analyse or to be

sure about. In reading a series of say 500 cases it would seem to be inevitable that these cases could not all be at the same stage of the disease. This fact always increased the difficulty of assessing the value of any treatment.

With regard to such a patient coming for examination and being found to have angina of effort or a syphilitic aortic incompetence, he felt the outlook depended very largely, perhaps entirely, upon whether treatment was going to accelerate the healing process by increasing the fibrosis, or whether it would help to relieve the more acute inflammatory stage. He thought that all physicians and syphilologists were only too much influenced by the possibility that the patient might go downhill as a result of treatment. It was clear from post-mortem investigation that the cause of this was an acceleration of the fibrotic process causing further interference